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Movement and Mental Imagery: Outlines of a Motor Theory of the Complexer Mental Processes. By MARGARET FLOY WASHBURN. Boston and New York, Houghton Mifflin Co., 1916.—Pp. xv, 252.

"From the point of view of scientific investigation no two subjects could present a stronger contrast than the two named in the title of this book. Movement is the ultimate fact of physical science. The measurement of the direction and velocity of movements is the most satisfactory achievement of science. . . . On the other hand, nothing could be less attractive to the scientific investigator with such an aim than the domain of mental imagery, the world of imaginary objects. Mental images are not only removed from general observation and open to direct study only by the individual who experiences them, but even he has no satisfactory way of measuring them and reducing them to mathematics." Nevertheless, the scientific investigator of mind may—as the author goes on to say in the Introduction—persist in "being curious about the 'inner aspect' of behavior and in believing that a man's thoughts are as legitimate objects for scientific study as his movements." If he does so persist, and if he also realizes "that it is through his movements that man takes his place in the rest of the order of nature, then the proper outcome of this twofold interest is an attempt to show that the whole of the inner life is correlated with and dependent upon bodily movement." While "this attempt is everywhere visible in the psychological theories of the past twenty years. . . . there still remain many phenomena connected with the complexer life of mind, the revival of past experiences and the construction of new thoughts and ideas, whose connection with motor processes has not been satisfactorily traced." This unestablished relation of the richer mental complexes to the movements of the body supplies the problem for the present serious and notable study.

Professor Washburn's doctrine of mind and organic movement has been sketched in previous articles. Now it is further elaborated and applied to the facts of imagery, association, action, and thought. It may be set forth in a few words.

Mind is intimately related to new combinations of simple movements innately provided; combinations organized during the life-time of the individual. These combinations are "movement systems," and a movement system is defined as "a combination of movements so linked together that the stimulus furnished by the actual performance of certain movements is required to bring about other movements." Systems are *static* (prolonged states of contraction and relaxation of muscle) and *phasic* (translations through space); and phasic systems are *simultaneous* and *successive* (chap. i). Now *all* consciousness is related to movement. The author resolves the antithesis which she finds between those theories which have been based upon free movements and those based upon obstructed movements by supposing that "consciousness accompanies a certain ratio of excitation to inhibition in a motor discharge." Complete blocking and complete want of inhibition alike destroy, or fail to produce, conscious processes. Thus mind always involves the ratio *excitation: inhibition;* but change in either term of the ratio (more or less excitation, more or less inhibition) may change its coloring and its temper; thus strong excitation of motor response with considerable checking and delay accounts for attention, still stronger excitation and weaker checking for smooth and rapid thinking, while a still greater balance of excitation over inhibition is exemplified in automatized and habituated actions.

Of primary importance to the theory is the distinction between *full* and *tentative* movements. Tentative movements are weak contractions of muscle. The theory demands an abundance of these (chiefly human) movements, which arise from cortical (as distinguished from thalamic) excitations. They are of much greater importance to consciousness than the gross movements of "behavior." "Upon the occurrence of tentative movements and their combination into simultaneous and successive movement systems will be based the whole theory outlined, in this work, of the nervous processes underlying the inner life of the mind. All thoughts and mental images, all the contents of consciousness, rest not simply on delayed full motor response, externally visible, but on delays in the systems of tentative movements. When these systems run smoothly, we have 'unconscious thought'; when delays occur, we have 'sensations' and 'images.'"

One further consideration is necessary to the general exposition of the theory. It concerns the functional relations of "sensory" and "motor centers" and "pathways." A discharging motor pathway under partial inhibition drains all sensory pathways connected with it at low synaptic resistance. Thus consciousness arises. When now a sensory pathway is excited by a stimulus, sensation results, when excited from another—always a motor—source, the image or centrally excited sensation results. The introspective difference between the sensation and the image is due to the "general motor disturbance" which follows peripheral stimulation.

It is inevitable that a doctrine of movement systems should bear upon some problems with more cogency than upon others. Its achievement with associative trains seems to the reviewer to be most remarkable, possibly because the facts there cited are most numerous and most tangled. Anyone one who has plowed through the literature from Müller and Schumann to the present year will appreciate the beauties of a conception which is able to set in order the conditions of impression, reproduction and recall, the nature of the memory after-image, the interplay of tendencies and dispositions, the laws of learning, and the mutations of imagery (chaps. v, vi, vii). Chapter v alone incorporates no fewer than thirty-six, and Chapter vi above forty, separate researches. If "perseveration" is overworked (the section seems to have been closed before Foster and De Camp appeared), and if the difference between the memory after-image and the "revived" image is exaggerated, the clarity and the thoroughness of the whole accomplishment can scarcely be too heartily praised. The empirical temper of the work is best illustrated in the treatment of Problem or Purpose (chap. viii) and of Imageless Processes (chap. x). The temptation to forsake the observational facts and to speculate upon mental activities and powers has seldom been resisted here even by recent writers from the laboratory. Professor Washburn brings the *Aufgabe* to earth in the "activity attitude," which she attaches to a static movement system, and she avoids the vagaries of the imageless thinkers, connecting, through the medium of kinaesthetic fusions, the attitude and the 'thought element' with sensation.

The value of the book rests less upon the form of the theory propounded (there has been no dearth of 'motor' theories since Ribot and Baldwin set the fashion), than upon the careful and precise attempt to interpret the psychological facts at hand in the light of a clearly formulated doctrine of bodily conditions. So the literature has been combed over and the facts of perception, imagery, after-image, associative, determining, and perseverative tendencies, meaning, attention, the Aufgabe, judgment, reasoning, creative thinking, imageless thought, attitudes, and dissociation have been marshalled for a candid explanation in terms of tentative movement systems.

The volume demands close reading. Every line calls for scrutiny and every section for backward and forward reference. In its difficulty, however, lies its principal virtue. To declare a conviction is easy, *e. g.*, to affirm that consciousness is always 'motor,' or that the brain is obviously a funnel for pouring energy into the muscles, or that it is evidently a system of synaptic sluiceways incapable of harboring such an *Unding* as consciousness. But to face the whole array of facts with courage and candor and to explain and reconcile them, bit by bit, in the light of a fairly simple hypothesis is by no means easy. This task the book essays. The magnitude of it is suggested by the appended bibliography of one hundred and sixty-two titles, all of which—and twice as many works besides—have been assimilated to the main problem. The volume virtually includes an outline of psychology which is rendered coherent and consistent by means of a fundamental principle of explanation. In its systematic command of facts it reminds the reader of Sherrington's *Integrative Action* and in its objective march through successive topics of Stumpf's classical *Tonpsychologie.*

It will, of course, be objected that consistent interpretation in terms of movement systems does not substantiate the existence of these systems as forming the essential basis of mind. It will be said that motor organization is rather a sequel of cerebral organization than a cause, that a sufficient variety and delicacy among tentative movements is an hypothesis that strains the facts at hand; that non-skeletal, static systems, that should carry purpose and explain determining tendencies and strong attention, are fanciful, and that the neurologist's knowledge does not preclude a real *central* organization which should account for association and attention. But, after all, such objections as these will acquire point and merit, in the face of the present performance, only when they have been welded together into a body of doctrine as coherent and useful as that presented in *Movement and Mental Imagery.* Furthermore, such criticism is really disarmed by the author herself when she declares that "nothing could be less dogmatic than the spirit in which this sketch of a motor theory of mental processes is put forward. There are grave dangers attending the attempt to form a complex and self-consistent theory where an appeal to fact is not possible at every step; and one of the chief dangers is that of taking self-consistency as equivalent to truth, of thinking that a subordinate hypothesis, for instance, must be true because it fits nicely with the rest of the theory, even though the whole structure be hung up in the air."

Psychology will, as it seems to the present writer, immediately and especially profit from Professor Washburn's book in two ways: First, by its empirical consideration of the problem of thinking, which had in spite of the enormous activity of the last decade, almost reached an *impasse;* and secondly, by its brilliant contribution to the constitution or organization of mind, an aspect which has been neglected alike by the analyst, the student of organic performance, and the inventor of mental activities and powers.

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